4.0 REDUCING MERCURY IN NEW HAMPSHIRE

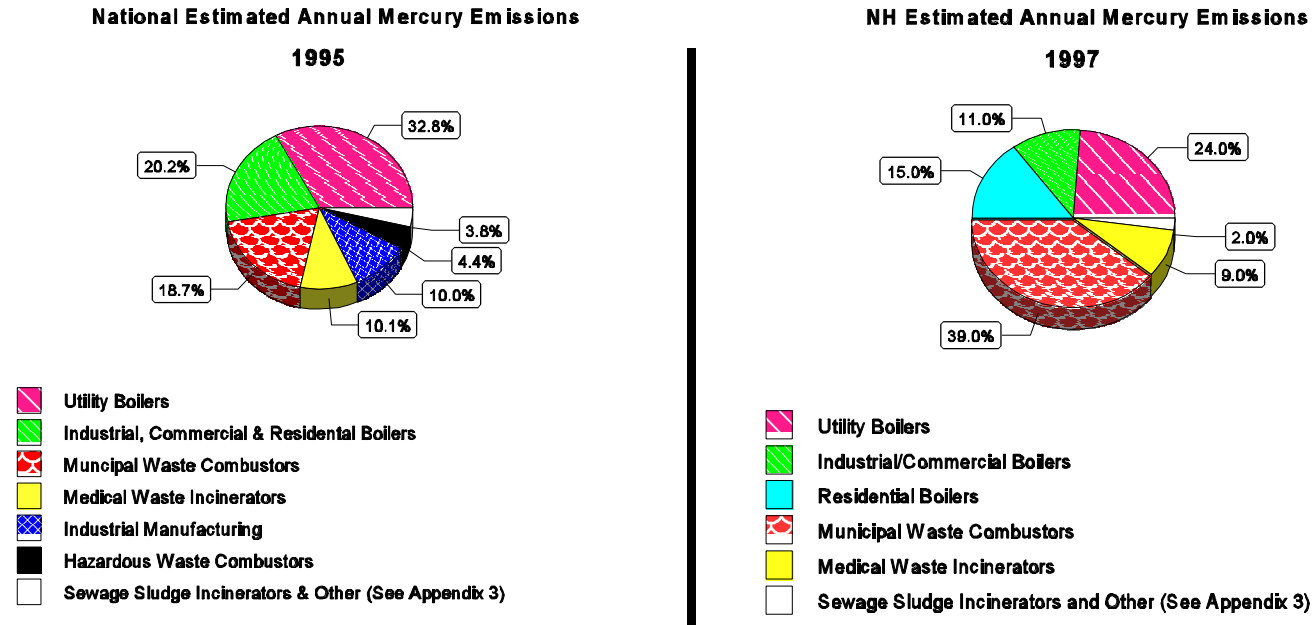
4.1 Introduction

Approximately 98% of the mercury released into the air in New Hampshire comes from the combustion of fossil fuels, such as coal and oil, and the incineration of waste (municipal solid waste and medical waste); the other 2% comes from sewage sludge incineration and other emission sources such as fluorescent lamp breakage and mobile sources. The burning of fossil fuels for the production of electricity and steam releases mercury during the combustion process. Facilities that burn coal have particularly high emissions of mercury. Facilities and devices that burn fossil fuels are not currently regulated for mercury emissions. In waste incineration, many discarded items (e.g., fluorescent lamps, electronic switches and components, and some thermometers and older batteries) contain mercury. When these items are burned, mercury is released from the incinerator stack.

In addition, non-emission sources such as the land application of sewage sludge, and medical and dental wastes also release mercury to the environment, but how much is not clear. Because mercury is highly persistent once released into the environment, all sources are cause for concern.

The major categories of sources that contribute mercury to the environment (see **Figure 5**), and strategies for reducing those contributions, are discussed in detail in the following sections. **Appendix 2** provides a comprehensive list of known New Hampshire mercury emissions sources, and **Appendix 3** contains a detailed comparison of state and national sources of mercury, by category.

Figure 5



Source: USEPA Mercury Study Report to Congress

Source: DES Air Emissions Data

4.2 Municipal Waste Combustors

4.2.1 Introduction

Municipal waste combustors (MWCs) comprise 39% of New Hampshire's mercury emissions. Two sizeable municipal combustors (located in Concord and Claremont), represent 35% of these emissions, while ten other small combustors represent the remaining 4%. EPA regulations for large combustors (combustion units that burn more than 250 tons per day) became effective on August 15, 1997. Due to its size, the only New Hampshire facility subject to these regulations is the Concord facility. DES has already completed rulemaking to implement these federal requirements and will submit an implementation plan to EPA by the end of 1998. The Concord facility will have one year from the date that EPA approves this plan to come into compliance with the regulations. Small MWCs (combustion units that burn less than 250 tons per day) will also be subject to new federal regulations for mercury emissions, but regulations for these facilities will probably not be drafted by EPA before the end of 1998 and are expected to affect only three New Hampshire facilities (Claremont, Pelham and Lincoln-Woodstock).

4.2.2 Large Municipal Waste Combustors

In New Hampshire, the two largest municipal waste combustors (the Wheelabrator facilities in Concord and Claremont) account for 90% of the mercury emissions from waste combustors and 35% of all mercury emissions in the State. It is important to note that these mercury emissions estimates are based on EPA's standard emission factors and may not accurately reflect the actual emissions from the Concord and Claremont facilities. Stack testing is the most reliable method for determining actual mercury emission rates from these sources. Single stack tests were performed at the Claremont facility in June 1993 and at the Concord facility in April 1995. In order to obtain more accurate and up-to-date emissions estimates, DES required stack tests to be performed at the Concord and Claremont facilities in the Spring of 1998. The 1998 stack test performed at the Concord facility showed a mercury emission rate of 0.0533 mg/dscm for Unit #1 and 0.152 mg/dscm for Unit #2. The control efficiency for Unit #1 was determined to be 81% (Unit #2 was not evaluated for control efficiency). The recent stack test performed at the Claremont facility revealed a mercury emission rate of 0.102 mg/dscm for Unit #1, and 0.214 mg/dscm for Unit #2. The control efficiency for Unit #2 was determined to be 31% (Unit #1 was not evaluated for control efficiency).

Currently, one state regulation and one federal regulation apply to mercury air emissions from large municipal waste combustors in New Hampshire. The state Air Toxics Control Program requires all stationary sources of mercury emissions (including MWCs) not to exceed a specified health-based ambient air limit (AAL). Both the Concord and Claremont facilities are in compliance with this regulation. The federal regulation will only apply to the Concord facility (as described above, this regulation only applies to combustion units that burn more than 250 tons per day). The new federal regulation will require the Concord

facility not to exceed a mercury emission rate of 0.080 milligrams (mg) per dry standard cubic meter (dscm) or to achieve an 85% control efficiency.

The *NEG/ECP Regional Mercury Action Plan* calls for regional adoption of a 0.028 mg/dscm emission limit for municipal waste combustors that have the capacity to burn more than 250 tons of municipal waste per day (i.e., the Concord facility). The *Regional Action Plan* also recommends evaluating the feasibility of adopting the same limit for smaller combustors with less than 250 ton per day capacity. Consistent with the *NEG/ECP Regional Mercury Action Plan*, DES plans to pursue the adoption of the 0.028 mg/dscm standard for the State's two largest combustors, the Concord and the Claremont facilities. Similarly, the states of Connecticut, Massachusetts, and Maine have introduced legislation to adopt the 0.028 mg/dscm limit. In addition, the State of Connecticut recently passed legislation to establish generation performance standards for mercury emissions from utilities (see Section 4.5).

There are no MWCs located in the States of Vermont and Rhode Island. However, Vermont recently passed legislation that requires any incinerator receiving solid waste from Vermont to use the best required technology consistent with federal law. Vermont entities will not be able to enter into new contracts or renew existing contracts for the incineration of solid waste, unless the facility is in compliance with all applicable federal regulations. This requirement would affect the Wheelabrator Claremont Facility since it currently receives solid waste from Vermont municipalities. The Vermont legislation also contains labeling requirements for mercury-containing consumer products.

The State of Maine has existing legislation that limits mercury emissions from any single source to one hundred pounds by the year 2000 and fifty pounds by the year 2004. Further, in order to keep mercury out of MWCs, Maine's legislation also directs its Department of Environmental Protection to draft additional legislation for the 1999 session that includes: 1) the establishment of a collection system through which mercury-containing products sold or offered for sale in the State can be returned for recycling to the manufacturer of the products, 2) the labeling of retail products that contain mercury, and 3) the imposition of a fee on the sale of mercury-added products.

Outside New England, the states of New Jersey and Florida have already adopted mercury emission regulations that are more stringent than even the new federal limit. New Jersey adopted rules controlling mercury emissions from MWCs in October 1994. Its rules require any facility capable of burning 9.6 tons per day or more of municipal solid waste to install and operate a mercury emissions control apparatus designed to reduce, at a minimum, 80% of mercury emissions by December 31, 1995. The emissions control equipment must be capable of reducing the concentration of mercury in the flue gas from 0.14 mg/dscm to 0.028 mg/dscm. The state of Florida adopted rules in October 1993 that limited mercury emissions to 0.070 mg/dscm for MWCs capable of burning 40 tons per day or more of municipal solid waste. Florida will be reviewing this regulation in September 1998 and is expected to lower it to 0.028 mg/dscm.

The type of mercury emission control equipment being used by the MWCs in both New Jersey and Florida is flue gas injection of activated carbon followed by a baghouse or electrostatic precipitator. EPA estimates the cost of installing an activated carbon system to be $500,000 - $1,000,000. Stack test data from both states has shown actual post-control mercury emission rates to be well below the 0.028 mg/dscm limit (e.g., three MWCs located in New Jersey, equipped with a baghouse and carbon injection system, achieved an average mercury emission rate of 0.0096 mg/dscm). By requiring the Concord and Claremont MWCs to install these controls, New Hampshire could reasonably expect a 95% reduction in mercury emissions from each facility. Using current emission inventory data, this would equate to a 33% reduction in statewide mercury emissions. **Appendix 4** summarizes a preliminary cost analysis conducted by DES of the potential cost impact to the New Hampshire communities of installing these controls at the Concord and Claremont facilities. State financial assistance to the affected communities is also being explored.

Industry representatives have expressed a concern with achieving the 0.028 mg/dscm emission limit on a consistent basis. However, based on data received from both the states of New Jersey and Florida, regarding MWCs equipped with a carbon injection system and a baghouse, DES is confident this limit can be achieved. Industry representatives are also concerned with the ability to accurately measure mercury emissions below 0.028 mg/dscm limit. DES has been assured by EPA that Method 29, which is the EPA approved stack test method used to measure mercury emissions, can measure mercury emission rates well below 0.028 mg/dscm. The detection limit for Method 29 is 0.00056 mg/dscm. The ability to test for mercury below the 0.028 mg/dscm limit has also been proven over the past several years by actual stack tests conducted in New Jersey and Florida on MWCs.

4.2.3 Small Municipal Waste Combustors

Ten small municipal waste combustors currently owned and operated by municipalities also contribute to mercury emissions in New Hampshire. Current estimates indicate that these sources contribute approximately 4% of the total mercury emissions in the State. Imposing a mercury emission limit of 0.028 mg/dscm would substantially reduce mercury emissions from these sources. However, because the volumes of waste processed by these facilities is so small, the cost-effectiveness of installing such sophisticated control equipment is questionable.

Currently, one state regulation applies to small municipal waste combustors. The state Air Toxics Control Program requires all stationary sources of mercury emissions (including small MWCs) not to exceed a specified health-based ambient air limit. Two representative combustors (located in Litchfield and Wilton) were computer modeled to determine their mercury emissions impact and compared to the acceptable mercury ambient air limit. Both combustors were found to be in compliance with the state regulation.

The *NEG/ECP Regional Mercury Action Plan* calls for states and provinces in the region to evaluate the feasibility of adopting a 0.028 mg/dscm limit for combustors under 250 tons per day, on a case-by-case basis. As noted above, achieving this standard by requiring emissions controls on very small combustors is probably not cost-effective. Removal of

mercury-containing sources from the solid waste stream prior to incineration should provide a more cost-effective means of reducing mercury from these sources. (See the discussion of Household/Municipal Solid Waste in Section 4.3) Whether individual municipalities choose to reduce mercury by installing control technology, diverting mercury-containing wastes prior to incineration or closing their incinerators, many will require financial assistance. Low interest loans and other forms of financial assistance should be explored for funding these activities as well.

4.2.4 Recommended Actions[1] Regarding Municipal Waste Combustors

R-1. Reduce mercury emissions from Municipal Waste Combustors (MWCs) by:

(a) Drafting legislation to require a mercury emission limit of 0.028 mg/dscm or lower for the State's two largest MWCs by January 1, 2002; and

(b) Evaluating, by September 30, 1999, the overall technical and economic feasibility of closing small MWCs over time or requiring small MWC's to meet a limit of 0.028 mg/dscm or lower.

R-2. Investigate and draft legislation, if appropriate, by November 1, 1999, to provide financial assistance to New Hampshire municipalities in implementing mercury reduction controls and programs.

R-3. Require annual emissions monitoring and stack testing in order to more accurately monitor actual mercury emissions from the State's two largest MWCs beginning in 1998.

R-4. Establish an external stakeholder workgroup (MWC Workgroup) by October 31, 1998 to, among other tasks, evaluate the need for periodic emissions testing at smaller MWCs. The workgroup should consist of representatives from DES, New Hampshire Department of Health and Human Services (DHHS), Business and Industry Association of New Hampshire (BIA), industry, municipalities, environmental groups and other interested parties.

[1] **Unless otherwise noted, the recommended actions indicated in this strategy are to be undertaken by DES.**

R-5. Encourage reductions in the amount of mercury-containing products entering the municipal waste stream through an Integrated Waste Management Strategy developed by the MWC Workgroup by:

(a) Continuing to work with the MWC operators, through the solid waste operator training program, to identify and remove mercury-containing wastes prior to incineration and ensure that those products are safely recycled (ongoing);

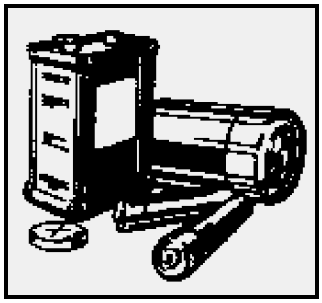
(b) Working with construction/demolition, recycling and other contractors and the MWC Workgroup to remove mercury-containing products such as thermostats and fluorescent tubes from construction and demolition debris and promote their safe recycling, by June 30, 1999; and

(c) Drafting legislation by November 1, 1999 (with an effective date of July 1, 2003) to prohibit the disposal of mercury-containing products and equipment in municipal waste combustors and medical waste incinerators. This legislation will serve as a backstop to ensure pollution prevention objectives are achieved.

4.3 Household/Municipal Solid Waste

4.3.1 Introduction

Mercury from municipal solid waste (MSW) is introduced into the environment primarily as emissions from Municipal Waste Combustors when solid waste is burned. The most common sources of mercury in municipal solid waste are older batteries and button batteries, fluorescent lamps, paint residue, some thermometers, thermostats and other products contributed by homeowners and businesses. Estimates made in the late 1980's of mercury contributions by waste type suggested that batteries and fluorescent lamps account for 85% of the mercury in MSW (72% from batteries and 13% from lamps). However, these estimates did not reflect recent state, federal, and manufacturer initiatives to eliminate mercury in nearly all types of batteries. By 1995, batteries were estimated to account for only 35% of the mercury in municipal solid waste. As the use of older batteries (those that still contain mercury) comes to an end, the amount of mercury contributed by batteries will fall drastically (EPA estimates zero contribution by the year 2000), and the relative contribution of other mercury-containing wastes will increase.



MSW in landfills may also be a source of mercury, but there are few documented cases of mercury contamination (e.g., of groundwater) from landfills. One EPA-funded study

suggested that leachate from municipal landfills does not contain mercury levels above the Toxicity Characteristic Leaching Procedure (TCLP), the test used to determine whether a waste contains hazardous amounts of heavy metals (like mercury) and organic chemicals (*Research Triangle Institute, 1993*). Much uncertainty remains about landfills as a source of mercury in groundwater or surface water, although there is concern that the disposal of mercury-containing lamps in landfills is an important source of air emissions. This is because most, if not all, fluorescent lamps destined for landfill disposal break, either during transport or through compaction at the landfill site, and release some of their mercury into the atmosphere.

The most effective long-term approach for reducing mercury in the solid waste stream is eliminating the presence of mercury in consumer products. Since most consumer products are sold nationally in interstate commerce, Congressional action is necessary to comprehensively address toxicity in the waste stream. A national approach to reducing the toxicity of consumer products would be less expensive and more effective than state-by-state approach. In the absence of such a national approach, however, the NEG/ECP Regional Mercury Action Plan will seek mercury reductions in consumer products. In addition, the states of Vermont and Maine have recently passed legislation requiring, among other things, the labeling of mercury-containing products and the development of manufacturer "take back" programs to ensure the proper management of those products. While DES supports this approach to minimizing the introduction of mercury into the environment, we strongly recommend the development of legislation to prohibit the non-essential use of mercury in consumer and commercial products.

Discussions on specific mercury-containing products and reducing their contribution to the solid waste stream are presented in the following sections.

CASE STUDY
Toxics in Packaging

New Hampshire has been a leader in the effort to reduce the mercury content of packaging which enters the solid waste stream. In 1988, the Coalition of Northeast Governors established a Source Reduction Task Force whose goal was to implement strategies leading to reductions in the heavy metals content of consumer product packaging. New Hampshire was instrumental in helping the Task Force develop a model "Toxics in Packaging" legislation. On April 19, 1990, New Hampshire became one of the first states nationwide to adopt a **Reduction of Toxics in Packaging** law (RSA 149-M:25-32), which limits mercury, lead, cadmium and hexavalent chromium in packaging. Although developed as a northeastern states initiative, 18 states across the country had adopted the law by 1998. Due to this legislation, many companies, including Digital, Eastman Kodak, IBM and Gillette have certified their packaging to meet the requirements of Toxics in Packaging legislation.

4.3.2 Batteries

In 1992, New Hampshire enacted innovative legislation aimed at reducing the mercury content in batteries. New Hampshire RSA 149-M:28 *Restrictions on Battery Sales and*

Disposal, restricted the sale of, and set mercury content limits for, all forms of batteries sold in New Hampshire. New Hampshire was one of the first states to enact such a law. Its passage was made possible by support from a broad range of stakeholders, including battery manufacturers. The law also required that batteries be easy to remove from products (to allow for recycling or proper disposal) and required clear labeling to warn consumers that the battery must be recycled or disposed of properly. Due in part to this ground-breaking legislation, many products including *Apple* computers, *Teledyne* Water Piks and *Black & Decker* rechargeable tools were redesigned to allow for easy battery removal and to include appropriate consumer labeling.

On May 13, 1996, all state and local laws governing battery labeling and disposal were preempted by the federal Mercury-Containing and Rechargeable Battery Management Act. In addition to strict labeling requirements, this law mandates that the handling of spent batteries be managed under the federal "Universal Waste Rule" (UW Rule) codified in EPA Regulation 40 CFR 273, even if a State has not adopted the UW Rule. The UW Rule encourages the recycling of mercury-containing and nickel-cadmium (Ni-Cd) batteries by streamlining handling requirements and by removing the permit application requirements for collectors and intermediate handlers. By the end of 1998, New Hampshire will propose the UW Rule for other types of waste as well, including mercury-containing lamps. DES is coordinating its drafting of the UW Rule with other states through participation in the Northeast Waste Management Officials Association's (NEWMOA) Universal Waste Workgroup.

While new batteries should not create mercury problems in MSW, older batteries will continue to be a presence, albeit a declining one. Along with older batteries, mercuric oxide "button" batteries (which contain 30% to 40% mercury by weight) are also a source of mercury in MSW. Although these batteries comprise only a minute fraction of the waste stream, they are a potent source of mercury and should be recycled. In addition, mercury may be present in batteries that were manufactured outside of the United States and imported into this country, although the extent of this problem is not well known.

4.3.3 Mercury-Containing Lamps

Mercury-containing lamps (fluorescents are the most common) are an important contributor of mercury emissions in municipal solid waste. These lamps are widely used because they are long-lasting and energy efficient. Although some lamp manufacturers have recently reduced the mercury content of their products, mercury is still required for the lamp to function, and significant amounts remain. Fluorescent lamps are expected to soon surpass batteries as the principal source of mercury in municipal solid waste.

Source reduction has been effective in eliminating mercury in batteries, but mercury is still essential for the functioning of a fluorescent lamp. The best effort by manufacturers (e.g., the Phillips ALTO and GE Ecolux models) has been to reduce the mercury level to less than 10 milligrams per lamp. Performing the Toxicity Characteristic Leaching Procedure (TCLP) on ALTO and GE Ecolux lamps, laboratories have consistently found

results below hazardous levels for leachable mercury of 0.2 mg/l. The TCLP is designed to measure the potential of hazardous constituents to leach into groundwater from a landfill. Although these low mercury lamps contain levels below TCLP, and would therefore not be regulated as hazardous waste in New Hampshire, they can still contribute mercury to the environment if not stored or transported in a manner that prevents breakage. When a lamp breaks, 6.8% of its mercury escapes into the dumpster, garbage truck or landfill. If mercury-containing lamps are incinerated without mercury controls, 90% of their mercury is released to the environment as air emissions, with the remaining 10% found in the fly ash and bottom ash (*EPA, June 1997*). Thus, every reasonable effort should be made to ensure that spent fluorescent lamps are recycled rather than disposed of as municipal solid waste.

Mercury reduction in lamps may actually reduce recycling rates by businesses and industry, because disposal of lamps that test below TCLP is allowed under current solid waste regulations. Lamps will continue to be a source of mercury released to the environment unless laws and regulations requiring recycling or prohibiting disposal are enacted, or until mercury-free lamps become available at a reasonable price.

New Hampshire has actively promoted environmentally sound recycling of mercury-containing lamps. In March 1994, DES established a policy that allows spent lamps, if kept intact and destined for recycling, to be exempt from the New Hampshire Hazardous Waste Rules. This policy encourages the recycling of lamps and the development of a lamp recycling infrastructure by eliminating the associated expenses of handling and disposing of mercury-containing lamps as a hazardous waste. The policy will be replaced by the NH Universal Waste Rule once it is adopted by the Department. The Universal Waste Rule will streamline requirements for the handling of spent mercury-containing lamps and encourage the environmentally sound management of spent lamps.

CASE STUDY
Compaq Computer Corporations'
Compaq Services De-Manufacturing Plant

At Compaq Services (formerly Digital Equipment Corporation) Contoocook, NH de-manufacturing plant, electronic equipment is disassembled and recycled. The facility serves 100 customers and handles approximately 25 million pounds of discarded electronic equipment annually. Not only does Compaq take back its own equipment, it accepts equipment, including copy machines, pagers, and computers, from all manufacturers. Less than one tenth on one percent of the material processed at the plant ends up in landfills. Much of the material is recycled, including plastics, ferrous and non-ferrous metals and glass, while many products are refurbished and sold to used equipment brokers. Materials such as gold, silver and platinum are extracted and sold for re-use. In addition to promoting disassembly and reuse of existing equipment, Compaq also advocates the design of products that are easier to disassemble and changing to manufacturing processes that use fewer and less toxic constituents. Compaqs' take-back program is an excellent example of corporate product stewardship throughout its entire life cycle. Similar programs could and should be undertaken for mercury-containing products.

Even with the streamlined requirements of the Universal Waste Rule, the collection and recycling of mercury-containing lamps by municipalities may not increase substantially due to limited municipal staff and financial resources. Households (unlike businesses, schools, institutions and government agencies) are not required to dispose of mercury-containing lamps as a hazardous waste. Lamps from households are only regulated under the hazardous waste rules if they are segregated from the rest of the MSW and collected. Although DES encourages municipalities to segregate, collect and recycle mercury-containing lamps, there is no regulatory mandate that they do so. Because commercial and industrial entities have to pay high hazardous waste disposal fees, there is an economic incentive for them to recycle mercury-containing lamps. This economic incentive does not exist for municipalities. Funding municipal collection of lamps for the purposes of recycling, similar to the DES program for collecting used oil, could significantly enhance the recycling rate. The cost to a community (with an existing transfer station) to set up such a program should be under $100, provided the municipality uses an existing building for storage. This figure does not include the cost of actually recycling the lamps, which is estimated to be approximately $31 per drum (one drum holds 85 lamps), with a $100 pick-up fee. Recycling costs would vary depending on the number of lamps actually recycled by a community.

The State of New Hampshire has an existing contract to recycle fluorescent lamps -- the first of its kind in New England. Municipalities are eligible and encouraged to recycle lamps under this contract, providing them with an opportunity to dispose of spent fluorescent lamps safely. Several New Hampshire communities have taken advantage of this opportunity and at least a dozen more have expressed interest in doing so. **Appendix 5** provides a detailed cost estimate for setting up a municipal lamp recycling program and provides information on the State lamp recycling contract.

4.3.4 Other Contributors

Items such as paint residues, thermostats, thermometers, electric switches (automobiles, appliances), electronic equipment and other miscellaneous products also contribute to mercury in municipal solid waste. In particular, thermostats, thermometers, and switches are estimated to contribute almost as much mercury as fluorescent lamps to the waste stream. Every effort should be made to divert mercury-containing components from the waste stream in order to prevent improper disposal or incineration. For example, the Thermostat Recycling Corporation (TRC) has instituted a national program to recycle mercury-containing thermostats and New Hampshire should make every effort to participate in this program, and others like it. DES should also work to encourage manufacturers to phase-out the use of mercury-containing switches in automobiles and large appliances. In addition, since trees take up mercury during growth, woodburning is suspected of emitting minute amounts of mercury into the environment as well.

4.3.5 Recommended Actions Regarding Household/Municipal Solid Waste

R-6. Continue efforts with municipalities and others to remove mercury-containing batteries from the waste stream and ensure safe recycling consistent with the Integrated Waste Management Strategy detailed in R-5 (ongoing).

R-7. By December 31, 2000, consistent with the Integrated Waste Management Strategy, encourage lamp manufacturers and vendors to reduce the mercury which enters the environment from their products by:

(a) Providing recognition for products with lower mercury content;

(b) Helping them establish "take back" programs to ensure safe recycling; and

(c) Providing information to consumers, through product labeling and other means, regarding mercury hazards and safe recycling of mercury-containing lamps.

R-8. Consistent with the Integrated Waste Management Strategy, encourage municipalities to implement lamp collection and recycling programs (similar to current municipal used oil collection programs or household hazardous waste collection days) by December 31, 2000 by:

(a) Providing technical assistance to municipalities in establishing such programs; and

(b) Providing financial assistance (e.g., through loans, grants or from product surcharges) to municipalities to assist in establishing such programs.

R-9. Beginning June 30, 1999, initiate a public outreach campaign, including mercury-oriented public service announcements to encourage greater citizen awareness of mercury hazards, alternatives to mercury-containing products and the need to safely recycle mercury-containing wastes.

R-10. Beginning June 30, 1999, conduct specific outreach to schools, institutions and government agencies on methods to eliminate the non-essential use of mercury (e.g. in labs) and safely manage and recycle mercury-containing wastes.

R-11. By December 31, 1999, draft rules for the permitting of recycling facilities in order to ensure mercury recycling is conducted in an environmentally sound manner.

R-12. Draft legislation to prohibit the non-essential use of mercury in consumer and commercial products for introduction in the 2000 New Hampshire Legislative Session.

R-13. By June 30, 1999, conduct outreach in conjunction with the BIA and DHHS to educate businesses about the health hazards of mercury, encourage compliance

with hazardous waste regulations and increase recycling and safe management of mercury-containing wastes.

4.4 Hospital/Medical/Infectious Waste Incinerators

New Hampshire's thirteen operating hospital/medical/infectious waste incinerators (HMIWIs) are also a source of mercury emissions, although recent HMIWI closings such as the WMI Medical Service of New England in Hudson and Dartmouth Hitchcock Medical Center eliminated almost 50% of HMIWIs emissions in New Hampshire. In medical and laboratory settings, mercury is often found in thermometers, vacuum gauges, manometers, switches, thermostats and button batteries. Mercury is also used in laboratories as a reagent and catalyst for such tests as Chemical Oxygen Demand (COD), and in staining, fixative, and preservative applications. As illustrated in Section 4.2, the *EPA Mercury Study Report to Congress* (*December 1997*) showed incineration of medical wastes to be responsible for 20% of mercury released into the air. New Hampshire estimates the mercury contribution to be approximately 9% from these sources.

New federal regulations for HMIWIs were finalized on August 15, 1997. These regulations require these sources to meet an emission limit of 0.55 mg/dscm. Soon after the EPA rule was issued, the Natural Resources Defense Council (NRDC) and the Sierra Club sued EPA, charging that the emissions standards were too lenient and did not provide adequate incentives for medical waste generators to adopt pollution prevention and waste reduction methods. This issue is currently under litigation, and oral arguments are scheduled to be heard in November, 1998. Although these EPA limits do not adequately limit mercury emissions, they are stringent enough to impact most HMIWI facilities. The *NEG/ECP Regional Mercury Action Plan* calls for the states and provinces to require HMIWIs to reduce mercury emissions to 0.055 mg/dscm, ten times more stringent than the EPA standard, but still double proposed limits on municipal waste combustors. DES is currently in the rulemaking process to establish a HMIWI regulation which will require applicable sources to meet the NEG/ECP recommended 0.055 mg/dscm mercury emission limit. This rule is expected to be adopted by November 1998. Once all sources are in compliance with the requirements of this rule (June 2000), DES estimates that mercury emissions from HMIWIs will be reduced by approximately 90%. This reduction will be accomplished through a combination of source reduction initiatives, source closures and the installation of pollution control equipment. Specific cost estimates to control mercury at HMIWIs are not readily available, but are likely to be comparable to those for small municipal waste combustors.

As with small municipal waste combustors, switching to non-mercury products, along with removal of mercury from the medical waste stream prior to incineration will likely be more cost-effective than installing emission controls. Fortunately, the use of mercury in medical and laboratory equipment and procedures is diminishing with the advent of non-mercury technologies

(such as digital thermometers) and changes in laboratory practices, including conversion to micro-scale procedures. Switching to non-mercury methods and products will be further encouraged through a Memorandum of Understanding (MOU) recently executed between the US Environmental Protection Agency and the American Hospital Association (AHA). Among other goals, the MOU calls for the "virtual elimination of mercury waste from the health care industry waste stream by the year 2005." This is a goal that New Hampshire also embraces and will work diligently to accomplish, in conjunction with other appropriate agencies and organizations. This area holds much promise for significant reductions in New Hampshire as several hospital facilities in the state have expressed interest in going "mercury free" and discussions with the New Hampshire Hospital Association indicate that they are supportive of this approach. DES is prepared to work cooperatively with the NHHA, DHHS, and other organizations and health care facilities to accomplish the goal of virtual elimination of mercury.

4.4.1 Recommended Actions Regarding Hospital/Medical/Infectious Waste Incinerators

R-14. Reduce mercury emissions from HMIWIs by:

(a) Requiring facilities to meet a mercury emission limit of 0.055 mg/dscm by January 1, 2002; and

(b) Establishing an external stakeholder workgroup (HMIWI Workgroup) by October 31, 1998 to, among other tasks, evaluate the technical and economic feasibility of reducing the HMIWI mercury emission limit to 0.028 mg/dscm or lower. This workgroup should consist of representatives from DES, DHHS, New Hampshire Hospital Association, industry, environmental groups and other interested parties.

R-15. Develop emissions testing requirements for HMIWIs by:

(a) Conducting initial DES emissions stack tests on representative sources by December 31, 1998; and

(b) Developing appropriate emissions testing requirements based on the findings of the initial DES emissions tests by June 30, 1999.

R-16. Establish a workgroup on Pollution Prevention in the Healthcare Industry (Healthcare Workgroup) by October 31, 1998 in order to facilitate the goal of virtual elimination of mercury-containing waste from the medical waste stream. The workgroup should consist of representatives from DES, DHHS, New Hampshire Hospital Association, industry, environmental groups and other interested parties. The workgroup will conduct outreach to health care providers and laboratories to encourage the use of alternative products and procedures, such as digital thermometers, manometers, and microscale chemistry methods, by January 1, 1999.

R-17. Require all generators of mercury-containing medical waste to introduce mercury source reduction and source separation programs by January 1, 2000.

R-18. Draft legislation, by November 1, 1999 (with an effective date of July 1, 2003), to prohibit the disposal of all mercury-containing products and equipment in medical waste incinerators (see R-5(c)). This legislation will serve as a backstop to ensure pollution prevention objectives are achieved.

4.5 Utility and Non-Utility Boilers

Coal-fired power plants and boilers (utility, industrial, commercial and residential) contribute 50% (24% from power plants, 26% from the other sources) of the mercury emitted in New Hampshire. Mercury is a natural constituent of coal and other fossil fuels, and it is liberated when these fuels are burned for the generation of power or heat. These sources are not currently regulated as mercury emitters.

EPA has recently requested data that would require owners of coal-fired utility boilers larger than 25 megawatts to measure, on a weekly basis, the mercury content of the coal they burn. The facilities will report the results to EPA, along with the corresponding volume of coal burned in each unit. EPA will use this data to determine whether or not mercury emissions from coal-fired utility boilers should be regulated at the federal level. In addition, the State of Connecticut has recently passed legislation that will also affect utility boilers burning coal as well as other fuels. Under this statute, the Connecticut Department of Environmental Protection is required to establish uniform performance standards for electric generating facilities supplying power to end users in the State. The standards are to be designed to improve air quality and will be based on the type of fuel being used. The standard will limit the emission rates of several pollutants including mercury.

Source reduction techniques which would reduce the mercury contribution from coal-fired power plants do exist, including: coal washing, conversion of plants to another fuel source (e.g., natural gas), energy conservation and alternative energy sources. However, these methods have not been widely used in the United States. Exploring the feasibility of implementing these methods should be part of any mercury reduction effort.

Conversion of power plants from coal to natural gas (or construction of new natural gas-fired generating plants), along with the implementation of energy conservation measures, would significantly reduce mercury emissions in New Hampshire and provide simultaneous large reductions in emissions of other pollutants such as nitrogen oxides, particulate matter and sulfur compounds, and greenhouse gases. This option holds considerable promise because a new natural gas pipeline is being constructed in the State.

Additional controls on utility boilers could also significantly reduce mercury emissions. For a coal-fired plant similar to Public Service Company of New Hampshire's (PSNH) Merrimack Station, requiring the use of existing technology such as activated carbon injection could achieve a 75% or better mercury control efficiency. These more stringent control measures would cost an estimated $19 million (capital) and $6.4 million in total annual costs (*US EPA, June 1996*). Over a 40 year life, the cost of such mercury control equipment translates to approximately a 1% increase in electric costs for the average consumer (*NHDES,1998*). If technically and economically feasible, controls on coal-fired power plants in New Hampshire would eliminate about 246 pounds of mercury emissions per year (16% of New Hampshire's annual emissions) and would have the added benefit of reducing other emissions including particulates (mercury control requires enhanced particulate control).

Large utility boilers, as well as smaller non-utility industrial/commercial boilers, burn a significant amount of #6 and #2 fuel oil which contains small amounts of mercury. Most recent estimates (1997) show that over 238 million gallons of #6 and #2 fuel oil are burned in these types of boilers each year in New Hampshire. The burning of this fuel represents 16% of the total mercury emissions in the State. These estimates also indicate that over 241 million gallons of #2 fuel oil are burned each year for residential use, representing 15% of the total mercury emissions in the State. Presently, no pollution control technologies exist that can cost effectively reduce mercury emissions from the burning of fuel oil. The only existing ways to reduce emissions from these sources is through energy efficiency (burning less oil) or by burning cleaner fuels (e.g., switching from #6 to #2 fuel oil or natural gas).

In addition to coal and oil-fired utility boilers, New Hampshire also has six wood-fired power plants. Because of the low mercury content in wood, the combined mercury emissions from all six facilities is approximately eight pounds per year.

4.5.1 Recommended Actions Regarding Utility and Non-Utility Boilers

R-19. Encourage greater implementation of energy efficiency and conservation programs for residential, commercial, and industrial customers by:

(a) Participating actively in New Hampshire Public Utility Commission (NHPUC) proceedings relating to energy efficiency (ongoing);

(b) Encouraging the initiation of and active participation in proceedings at the NHPUC (and in regional efforts) relating to disclosure of the environmental characteristics of power sales (ongoing);

(c) Assisting New Hampshire's Interagency Energy Efficiency Committee in energy saving efforts such as expeditiously adopting Energy Star Building Programs for State buildings (1998-2003); and

(d) Assisting the Governor's Office of Energy and Community Services in outreach to electricity consumers about reducing mercury emissions through greater energy efficiency (ongoing).

R-20. Reduce mercury emissions from utility and non-utility boilers by:

(a) Encouraging expeditious development of lower-mercury generation sources such as natural gas, solar photo-voltaics and fuel cells through permitting processes and in the allocation of emission allowances (ongoing).

(b) Establishing an external stakeholder workgroup (Electric Workgroup) by October 31, 1998, which should consist of representatives from DES, DHHS, utility industry, environmental groups and other interested parties, to assess the technical and economic feasibility of:

1. **Requiring a 75% reduction in mercury emissions from coal-fired power plants by the year 2005;**

2. **Repowering coal-fired power plants in New Hampshire to natural gas (study to be completed by September 30, 1999); and**

3. **Switching from #6 fuel oil to #2 fuel oil or natural gas (study to be completed by September 30, 1999).**

4.6 Wastewater and Sludge

4.6.1 Introduction

It is generally agreed that non-combustion sources, such as municipal wastewater discharges, industrial, commercial and residential wastewater discharges, and sludge contribute from a trace amount to 4% of the environmental mercury loading. Typical New Hampshire wastewater treatment facility test results for mercury are presented below.

Figure 6

AVERAGE MERCURY LEVELS IN NEW HAMPSHIRE EFFLUENT AND SLUDGE

Source	Influent (mg/l)	Effluent (mg/l)	Sludge (mg/kg)
Concord	**<0.002**	**<0.002**	**2.01**
Claremont	**(not avail.)**	**0.0008**	**0.46**
Dover	**<0.0002**	**<0.0002**	**0.90**
Manchester	**<0.0002**	**<0.0002**	**1.60**
Merrimack	**<0.0007**	**<0.001**	**0.49**
Milford	**<0.0005**	**<0.0005**	**0.94**
Nashua	**<0.004**	**<0.004**	**<0.22**
Somersworth	**<0.0002**	**<0.0002**	**1.00**
Franklin	**0.001**	**<0.001**	**4.05**

Source: NHDES Industrial Pretreatment Program, 1996 Annual Pretreatment Reports

Note: Results showing "<" refer to a quantity less than detection limits.

4.6.2 Wastewater

Past research has indicated that the small amount of mercury found in sewage becomes bound up in sludge rather than discharged in treatment plant effluent to New Hampshire waterways. The recent development of new water quality testing procedures may shed new light on this potential source of mercury. On May 15, 1998 EPA proposed a new mercury detection method (method 1631) for water which allows detection of mercury at a minimum level of 0.05 parts per trillion (ppt). Current detection methods cannot detect mercury levels below 200 ppt, thus the new method will allow the detection of mercury in wastewater effluent at much lower levels than previously possible.

Adoption of this new method, which is currently undergoing a public comment period, will likely result in lower mercury standards under the National Pollutant Discharge Elimination System (NPDES) permitting program for wastewater dischargers. Under EPA's Great Lakes Initiative, the health based standard for mercury is 1.8 ppt. With the new detection method, this standard may be more widely applied outside of the Great Lakes area. This may affect a diverse group of industries that have not had a problem complying with discharge limits. In New Hampshire, there are currently no industrial facilities or wastewater treatment plants with mercury effluent discharge limits. How many of these industries will be subject to mercury limits in the future remains to be seen. Method 1631 may also drive new efforts to curb the deposition of airborne mercury, particularly from coal-burning utilities.

Pollution prevention techniques will be extremely important in reducing both effluent and emission levels of mercury. Due to the potential ramifications of this new detection method, DES should carefully monitor the developments surrounding the this method, and encourage the expeditious adoption of the method by EPA. In addition, DES should begin collecting sampling data as soon as possible, on background levels of mercury in New Hampshire's lakes and rivers, in order to have a means by which to compare effluent levels of mercury with background levels.

4.6.3 Sludge

A recent comprehensive evaluation of mercury levels in New Hampshire sludge revealed that 99% of all sludge that is currently applied to land as fertilizer had values less than 4.8 mg/kg, with a maximum value of 7.7 mg/kg. The average value for land-applied sludge was 1.5 mg/kg. These values are well below the current EPA "exceptional quality" limit of 17 mg/kg for land applied sludge. Using the average concentration of mercury in sludge of 1.5 mg/kg, multiplied by the roughly 18,600 tons of sludge land-applied in New Hampshire annually, the total mercury discharged equals about 24,500 grams, or 54 pounds. Approximately two-thirds of the land-applied sludge is generated in New Hampshire, while one-third comes from out-of-state sources. Out-of-state sludge has been found to have mercury levels comparable to sludge generated in New Hampshire. Most research indicates that mercury in sludge is tightly bound and tends to remain tightly bound to the soil. The rate of conversion to methyl mercury, the most dangerous form of mercury to humans and living organisms, is greatly enhanced by anaerobic biological activity, which does not normally occur in land application situations. A recent study published in the *Journal of Environmental Quality* (*Carpi, et. al., 1997*) suggests that mercury in land-applied sludge may be a more significant source of emissions than previously thought. In their study, the researchers stated that the data was too limited to be conclusive and recommended further investigation. DES will continue to evaluate new information on mercury in sludge as it becomes available and provide for regulatory adjustments as needed.

The Division of Public Health Services, Bureau of Health Risk Assessment (BHRA) has been addressing the questions of risk of communicable disease from exposure to sewage sludge and the risk of adverse health effects from exposure to chemicals in sludge. In March 1996, DES adopted rules to augment EPA's CFR 503 regulations to ensure that land application of sludge does not endanger human health or environment. Based on exposure limits that would not result in adverse health effects, these regulations allow mercury concentrations in sludge of up to 57 mg/kg and set an "exceptional quality" limit of 17 mg/kg.

To further ensure the protection of public health and the environment, DES is currently in the process of adopting new Sludge Management Rules (Env-Ws 800) which will set a mercury concentration limit of only 10 mg/kg. This is equal to the most stringent standard currently in place in New England (Vermont and Massachusetts also have this standard). These rules will further reduce the limit to 7 mg/kg effective January of 2001, making this mercury limit the most stringent in New England (provided the other states do not lower their limits). These New Hampshire standards are five and eight times more stringent respectively than the concentrations allowed by federal standards, and 1.5 and 2.4 times more stringent than the federal Part 503 - Table 3, Pollutant Concentration Limits. It is worth noting that the mercury levels currently found in New Hampshire sludge are generally less than or equal to amounts found in commercially manufactured fertilizers.

New Hampshire has one sludge incineration facility currently operating. The facility is located in Manchester and is estimated to contribute less than 1% of the total mercury emissions in the state. Although this is a relatively small contribution to the overall emissions inventory, sludge incinerators and recommendations to reduce their mercury contribution are specifically addressed in the *Regional Mercury Action Plan*. Consistent with regional efforts, actions should be taken in New Hampshire to evaluate the actual contribution of mercury from this source and methods to reduce that contribution.

4.6.4 Recommended Actions Regarding Wastewater and Sludge

R-21. Adopt stringent rules for mercury in wastewater sludge, setting a limit of 10 mg/kg upon adoption in 1998 and reducing that limit to a more stringent, technology-based limit by 2001.

R-22. Evaluate the technical and economic feasibility of adopting stringent rules for mercury in wastewater discharges, setting a health-based limit of 1.8 parts per trillion. Study to be completed by June 30, 2000.

R-23. Conduct outreach, through the DES Industrial Pretreatment and Pollution Prevention Programs, to eliminate or minimize the non-essential use of mercury in industrial, commercial, government, educational and residential facilities, by September 30, 1999.

R-24. Develop a water quality sampling program to determine background levels of mercury in surface waters of the state and existing effluent levels at industrial

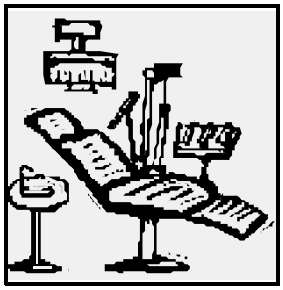
facilities and wastewater treatment plants (upon adoption of EPA Method 1631).

R-25. Require an emission stack test at the Manchester Sludge Incinerator by June 30, 1999, in order to establish its current mercury emission rate and to develop future periodic emissions testing requirements.

R-26. By June 30, 1999, evaluate the feasibility of adopting a 0.01 mg/dscm or lower mercury emission limit for the Manchester sludge incinerator.

4.7 Dental Amalgam

Amalgam, a dental filling material which contains mercury, is a 1:1 mixture of mercury and an alloy consisting of silver, tin, copper and zinc. Only 45% of the mercury used by dentists is incorporated into the new amalgam filling in the mouth. Smaller amalgam particles collected in the vacuum equipment trap are disposed of in the trash, or they pass through the trap and are released to the sewer system or subsurface sewage disposal system. Dental wastes are a source of mercury in wastewater discharges as well as in air emissions if captured amalgam is disposed in municipal solid waste and later incinerated. Alternatives to mercury-containing dental amalgam are available and should be evaluated for use by New Hampshire dentists.



CASE STUDY
Mercury-Free Amalgam

Like a number of other dentists, five years ago, Dr. David Bloom, a Salem, NH dentist, began to switch from mercury-containing amalgam to new, plastic resins for filling his patients' cavities. Plastic resins have been under development for about ten years, and recently a practical formulation been found that adheres to both the enamel and dentin of the tooth. As a result, Dr. Bloom has now completely eliminated the use of mercury amalgam in his practice.

Plastic resins take twice as long as mercury amalgam to apply, so there is an added cost to their use. However, by using plastic resins, the generation of mercury wastes is avoided, and Dr. Bloom has eliminated the costs of managing and disposing of amalgam as a hazardous waste. Furthermore, Dr. Bloom's patients prefer plastic resins because the plastic can be tinted to match the color of the tooth, making the filling invisible. More importantly, plastic resins adhere through a chemical bond to the surface of the tooth, so their application requires far less tooth to be removed than a traditional amalgam filling, which requires the cavity to be greatly enlarged inside the tooth.

Dr. Bloom and many of his patients are also well aware of the environmental benefits of eliminating the use of mercury-containing amalgam. Asked if he could think of any reason why a dentist might prefer to use mercury-containing amalgam, Dr. Bloom replied, "It's like asking anyone today if they'd prefer to listen to scratchy old 45s rather than CDS."

4.7.1 Recommended Actions Regarding Dental Amalgam

R-27. By June 30, 1999, conduct outreach to the general public and dentists' offices in conjunction with the New Hampshire Dental Society to encourage the voluntary use of alternatives to mercury-containing amalgam; and encourage the proper collection and disposal of waste amalgam.

R-28. Draft legislation, by November 1, 1999 (with an effective date of July 1, 2003) to prohibit the use of mercury-containing amalgam. This legislation will be used as a backstop to ensure that pollution prevention objectives are achieved.

4.8 Industrial Processes

Nationally, 92% of industrial mercury releases to the environment are from primary lead production, secondary mercury production, chlor-alkali production (production of chlorine and sodium hydroxide), and Portland cement production. None of these industries have operations in New Hampshire. Industries operating in New Hampshire that use mercury in their processes include manufacturers of electrical equipment, instruments, batteries and fluorescent lamps. These potential sources of mercury pollution are not believed to be significant, because they are already required by federal and state regulations to properly manage and dispose of wastes containing toxic constituents such as mercury as regulated hazardous wastes.